REMARKS

The Office Action dated July 11, 2007 has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

Claims 31, 36, 53, 57 and 58 are amended to more particularly point out and distinctly claim the subject matter of the present invention. Claim 35 is cancelled without prejudice or disclaimer. Support for the amendments is found at least on cancelled claim 35. No new matter as added. Claims 31-34, 36-59, and 73-75 are respectfully submitted for consideration.

The Office Action objected to claims 31, 33, and 57 because of informalities. Specifically, the Office Action requested that "signalling" be replaced with "signaling". Applicants respectfully submit that claims 31, 33 and 57 are amended as requested in the Office Action. Accordingly, withdrawal of the objection to the claims is respectfully requested.

The Office Action rejected claims 31-35, 37-46, 48-59 and 73-75 under 35 U.S.C. 102(e) as being anticipated by US Patent Publication No 2002/0196842 to Onggosanusi et al. (Onggosanusi). Applicants respectfully submit that Onggosanusi fails to disclose or suggest all of the features recited in any of the pending claims. The rejection of claim 35 is moot in light of the cancellation of this claim.

Claim 31, from which 32-34, 36-52 and 73 depend, is directed to a method of transmitting complex symbols using a transmission code matrix. The transmission code

matrix is constructed. The transmission code matrix, is transmitted at least partially in parallel, using substantially orthogonal signalling resources and at least three different transmit antenna paths. The transmission code matrix can be expressed as being constructed using at least two transformed transmit diversity code matrices. Both the matrix dimensions of the transmission code matrix are greater than the corresponding matrix dimensions of the transformed transmit diversity code matrices. The transformed transmit diversity code matrices are expressed as being constructed by transforming at least two transmit diversity code matrices using linear transformations. The transmit diversity code matrices, at least one of which is of dimension greater than one, can be expressed as being formed by modulating at least two at least partially different streams of complex symbols that are obtainable from a single stream of complex symbols by conversion.

Claim 53, from which claims 54-56 and 74 depend, is directed to an apparatus for transmitting complex symbols using a transmission code matrix. Components are configured to construct a transmission code matrix out of complex symbols. A transmission unit is configured to transmit the transmission code matrix, at least partially in parallel, using substantially orthogonal signalling resources and at least three different transmit antenna paths. The transmission code matrix can be expressed as being constructed using at least two transformed transmit diversity code matrices. Both the matrix dimensions of the transmission code matrix are greater than the corresponding matrix dimensions of the transformed transmit diversity code matrices. The transformed

transmit diversity code matrices can be expressed as being constructed by transforming at least two transmit diversity code matrices using linear transformations. The transmit diversity code matrices, at least one of which is of dimension greater than one, can be expressed as being formed by modulating at least two at least partially different streams of complex symbols that are obtainable from a single stream of complex symbols by conversion.

Claim 57, from which claim 75 depends, is directed to a system comprising a transmitter for transmitting complex symbols using a transmission code matrix, and a receiver for receiving transmitted complex symbols. The transmitter includes components configured to construct a transmission code matrix out of complex symbols. A transmission unit is configured to transmit the transmission code matrix, at least partially in parallel, using substantially orthogonal signalling resources and at least three different transmit antenna paths. The transmission code matrix can be expressed as being constructed using at least two transformed transmit diversity code matrices. Both the matrix dimensions of the transmission code matrix are greater than the corresponding matrix dimensions of the transformed transmit diversity code matrices. The transformed transmit diversity code matrices can be expressed as being constructed by transforming at least two transmit diversity code matrices using linear transformations. The transmit diversity code matrices, at least one of which is of dimension greater than one, can be expressed as being formed by modulating at least two at least partially different streams

of complex symbols that are obtainable from a single stream of complex symbols by conversion.

Claim 58, from which claims 59 depends, is directed to a transmission code matrix, which is to be transmitted at least partially in parallel on at least three different transmit antenna paths using substantially orthogonal signalling resources. The transmission code matrix can be expressed as being constructed using at least two transformed transmit diversity code matrices. Both the matrix dimensions of the transmission code matrix are greater than the corresponding matrix dimensions of the transformed transmit diversity code matrices. The transformed transmit diversity code matrices can be expressed as being constructed by transforming at least two transmit diversity code matrices using linear transformations. The transmit diversity code matrices, at least one of which is of dimension greater than one, can be expressed as being formed by modulating at least two at least partially different streams of complex symbols that are obtainable from a single stream of complex symbols by conversion.

Embodiments of the present invention relate to the transmission of complex symbols using a transmission code matrix. The transmission code matrix is constructed and transmitted at least partially in parallel, using substantially orthogonal signaling resources and at least three different transmit antenna paths. The transmission code matrix can be expressed as being constructed using at least two transformed transmit diversity code matrices. The transformed transmit diversity code matrices can be expressed as being constructed by transforming at least two [transmit diversity] code

matrices using linear transformations. The transmit diversity code matrices, at least one of which is of dimension greater than one, can be expressed as being formed by modulating at least two at least partially different streams of complex symbols that are obtainable from a single stream of complex symbols by conversion. Applicants respectfully submit that each of the above claims recites features that are neither disclosed nor suggested by Onggosanusi.

Onggosanusi describes a wireless communication system 100 (see Fig. 4) wherein a transmitter 102 is used to communicate independent symbol streams and where, prior to transmission, those streams are transformed using a linear basis $V^{(n)}$ (in multiplier instance 107). Preferably, the linear basis $V^{(n)}$ is selected by the receiver 104 from a finite set of N different bases $\{V^{(n)}\}_{n=1}^{N}$, and an identification of the selected basis $V^{(n)}$ is fed back from the receiver 104 to the transmitter 102.

Onggosanusi describes and illustrates in paragraph [0082], with reference to Fig. 4, a system where two STTD encoders 105_1 and 105_2 are deployed to set up two 2x2 Alamouti matrices (see Fig. 4 and paragraph [0083]). The four outputs of the two STTD encoders are then fed into a multiplier instance 107, where a multiplication with a linear basis $V^{(n)}$ takes place. Therein, for the case of P=4 transmit antennas, $V^{(n)}$ is a 4x4 matrix. Examples for $V^{(n)}$ are given in equations (51), (52) and equations (54)-(59).

The transmitter 102 of the system 100 in Fig. 4 of Onggosanusi implements a method of transmitting complex symbols. For this transmission, a transmission code matrix is used, which is represented by the two STTD encoder blocks 105_1 and 105_2 and

the multiplier instance 107, in which a multiplication with the linear basis transformation matrix $V^{(n)}$ takes place. Therein, the STTD encoder 105_1 can be represented by

$$C_1 = \begin{bmatrix} s_{1,1} & s_{1,2} \\ -s_{1,2}^{*} & s_{1,1}^{*} \end{bmatrix}$$

and the STTD encoder 105_2 can be represented by

$$C_2 = \begin{bmatrix} s_{2,1} & s_{2,2} \\ -s_{2,2}^{*} & s_{2,1}^{*} \end{bmatrix},$$

and a 4x2 transmission code matrix can then be expressed as

$$C = V^{(n)} \cdot \begin{bmatrix} C_1 \\ C_2 \end{bmatrix}.$$

Thus, in the system of Fig. 4 of Onggosanusi, a transmission code matrix C is constructed.

The transmission code matrix C can be expressed as being constructed using at least two matrices. This is the case since the 4x2 matrix C can be written as

$$C = V^{(n)} \cdot \begin{bmatrix} C_1 \\ C_2 \end{bmatrix} \equiv \begin{bmatrix} X_2 \\ X_1 \end{bmatrix}$$

In equation (51) of Onggosanusi, an example for the linear basis transformation matrix $V^{(n)}$ is given, where θ_n is defined in equation (36). For N=2, i.e. when the linear basis transformation matrix $V^{(n)}$ is selected by the receiver from a set of 2 linear transformation matrices, the second linear basis transformation matrix $V^{(2)}$ is given as (with $\theta_2 = \pi/4$ according to equation (36)):

$$V^{(2)} = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 0 & -1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix},$$

and the corresponding transmission code matrix would be obtained as

$$C = V^{(2)} \cdot \begin{bmatrix} C_1 \\ C_2 \end{bmatrix} = \begin{bmatrix} C_1 - C_2 \\ C_1 + C_2 \end{bmatrix} \equiv \begin{bmatrix} X_2 \\ X_1 \end{bmatrix}.$$

Therein, the transformed transmit diversity matrices X_2 and X_1 are thus the difference and the sum of the transmit diversity matrices C_1 and C_2, respectively, i.e. are linear transformations of the transmit diversity matrices C_1 and C_2.

Applicants respectfully submit that Onggosanusi fails to disclose or suggest at least the feature of "both the matrix dimensions of said transmission code matrix are greater than the corresponding matrix dimensions of said transformed transmit diversity code matrices," as recited in claims 31, 53, 57, and 58.

Applicants respectfully submit that, as discussed above, Onggosanusi merely describes that the matrix C is a 4x2 matrix, whereas according to the presently claimed invention a transmission code matrix C of 4x4 is featured (see for instance equations (6), (7) and (10) of the present application). As discussed above, support for this feature is in cancelled claim 35. The Office Action took the position that Onggosanusi disclosed this feature in paragraph [0062].

However, as illustrated in Fig. 3 of Onggosanusi, in case P=2 (2 transmit antennas), the linear basis transformation matrix $V^{(n)}$ is of dimension 2x2. However, in

Fig. 3, there isn't any transmission code matrix that would be composed of transformed transmit diversity matrices, since there are no transmit diversity (STTD) matrices in the embodiment of Fig. 3. As discussed above, the only transmission code matrix in Onggosanusi is the matrix C represented by the two STTD encoder blocks 1051 and 1052 and the multiplier instance 107 in Fig. 4. This transmission code matrix C is of dimension 4x2, wherein the dimensions of matrices X_1 and X_2 are 2x2. Thus, Onggosanusi fails to describe that both dimensions of the transmission code matrix C are greater than the corresponding matrix dimensions of the transformed matrices X_1 and X_2.

Applicants further submit that because claims 32-34, 37-46, 48-52, 54-56, 59 and 73-75 depend from claims 31, 53, 57 and 58, these claims are allowable at least for the same reasons as claims 31, 53, 57 and 58, as well as for the additional features recited in these dependent claims.

Based at least on the above, Applicants respectfully submit that Onggosanusi fails to disclose or suggest all of the features recited in claims 31-35, 37-46, 48-59 and 73-75. Accordingly, withdrawal of the rejection under 35 U.S.C. 102(e) is respectfully requested.

The Office Action objected to claims 36 and 47 for being dependent from a rejected base claim. Applicants are grateful for the acknowledgement that these claims would be allowable if rewritten into independent form. However, Applicants respectfully submit that because these claims depend from claim 31, these claims are allowable in their present format at least for the same reason as claim 31 as well as for the additional

features recited in these claims. Accordingly, withdrawal of the objection to these claims is respectfully requested.

Applicants respectfully submit that each of claims 31-34, 36-59, and 73-75 recites features that are neither disclosed nor suggested in Onggosanusi. Accordingly, it is respectfully requested that each of claims 31-34, 36-59, and 73-75 be allowed, and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

David E. Brown
Registration No. 51,091

Customer No. 32294
SQUIRE, SANDERS & DEMPSEY LLP
14TH Floor
8000 Towers Crescent Drive
Tysons Corner, Virginia 22182-2700
Telephone: 703-720-7800
Fax: 703-720-7802

DEB/cqc/jkm